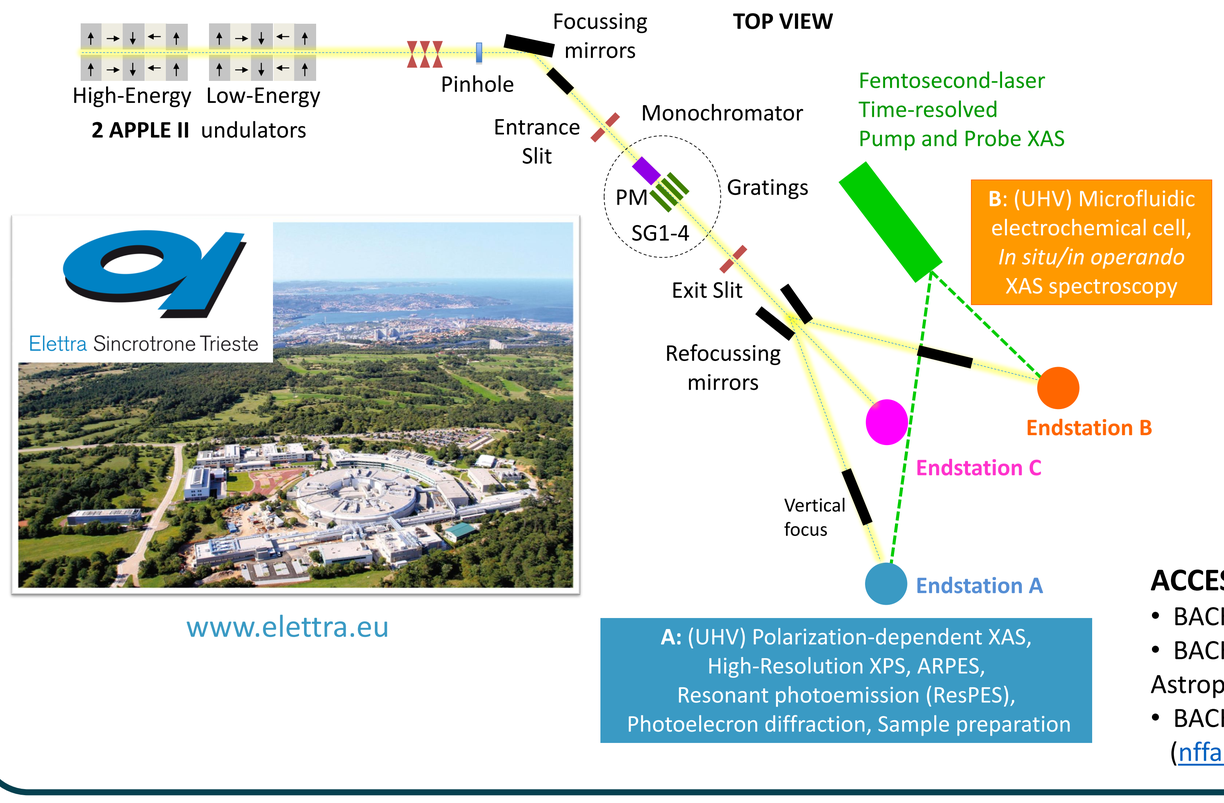
ISTITUTO OFFICINA DEI MATERIALI

Nano Innovation 2024 Conference & Exhibition — Rome, 9-13 September

Few-layer and single-layer MoS_2 studied by synchrotron radiation photoemission and X-ray absorption spectroscopy

Igor Píš and Federica Bondino, CNR - Istituto Officina dei Materiali (IOM), Trieste, Italy

BACH Beamline for Advanced diCHroism



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RESEARCH AREAS
Material Science
Surface Science
Physical Chemistry
Astrophysics
Electrochemistry

ENERGY RANGE
44 eV – 1650 eV

SOURCE
Two Apple II type helical undulators
Selectable horizontal, vertical, circular polarization

MAIN TECHNIQUES AND METHODS
High-Resolution
X-ray Photoelectron Spectroscopy
Angle-resolved, resonant,
fast and temperature-programmed PES

X-Ray Absorption Spectroscopy (XAS)
- total fluorescence and electron yield
- partial and Auger electron yield
- linear and circular dichroism (XLD, XMCD)
- time-resolved XAS (sub-ns)
- *-in situ/in operando* at solid/liquid interfaces

Photon energy resolution:
6 meV @ 44eV, 30 meV @ 500 eV, 500 meV @ 1650 eV
Typical beam size: 350×150 µm²
Flux: 10^{10} - 10^{12} Photons/s

Consiglio Nazionale delle Ricerche

ACCESSIBILITY
- BACH is accessible via accepted experiments on public time, scientific collaborations and commercial contracts
- BACH is part of the BABE facility (babe.iom.cnr.it) accessible through the Integrated Activities for the High Energy Astrophysics Domain (AHEAD2020) Trans-National Access Programme
- BACH is accessible through the Nanoscience Foundries & fine analysis (NFFA) Trans-National Access Programme (nffa.eu)

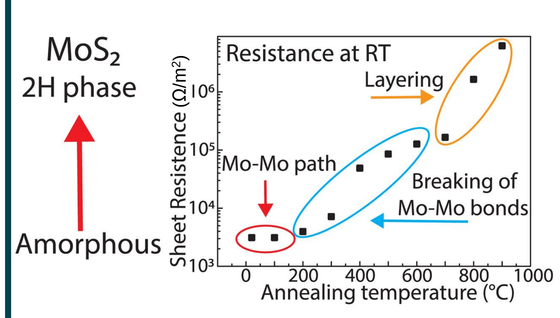
Amorphous-to-crystal transition in thin MoS_2

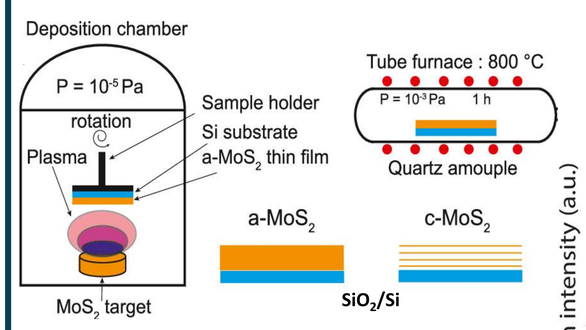
Phase-change data storage devices

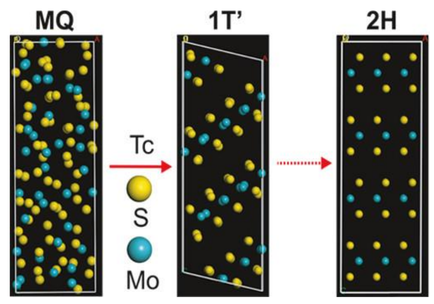
- Anomalous electrical conductivity change in MoS_2 during crystallization.

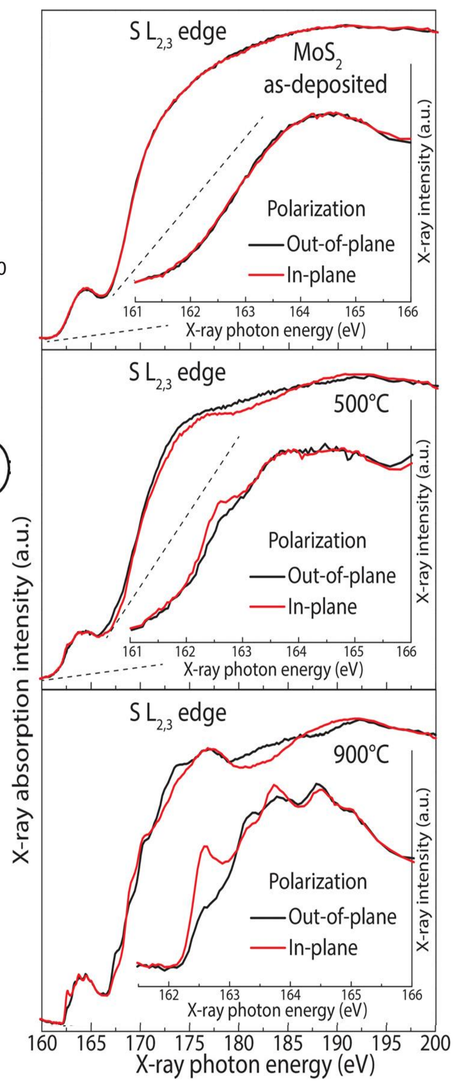
XAS spectroscopy

Light polarization dependence
- crystallization, 2H phase
- *c*-axis orientation









- M. Krbal et al., ACS Appl. Nano Mater. 2021, 4, 8834−8844
- M. Krbal et al., Ceramics International 49 (2023) 2619–2625
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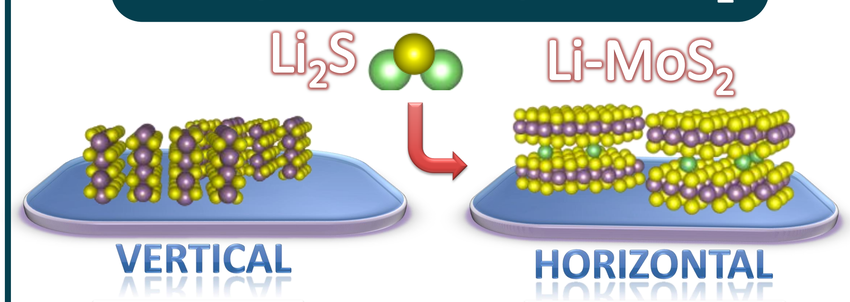
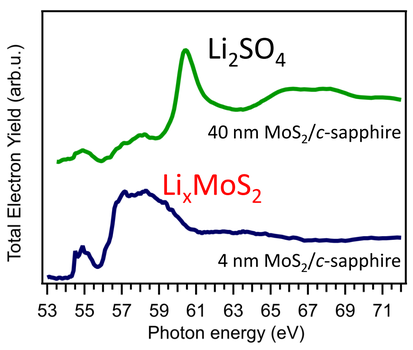
Li-doped few-layer MoS_2



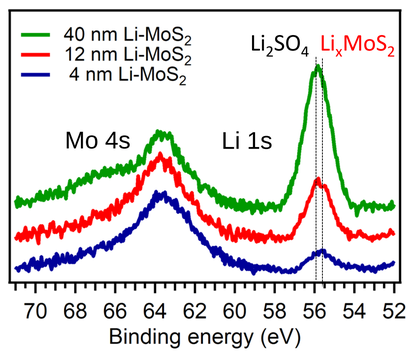
Li K-edge XAS

Spectroscopic fingerprint of Li intercalated MoS_2

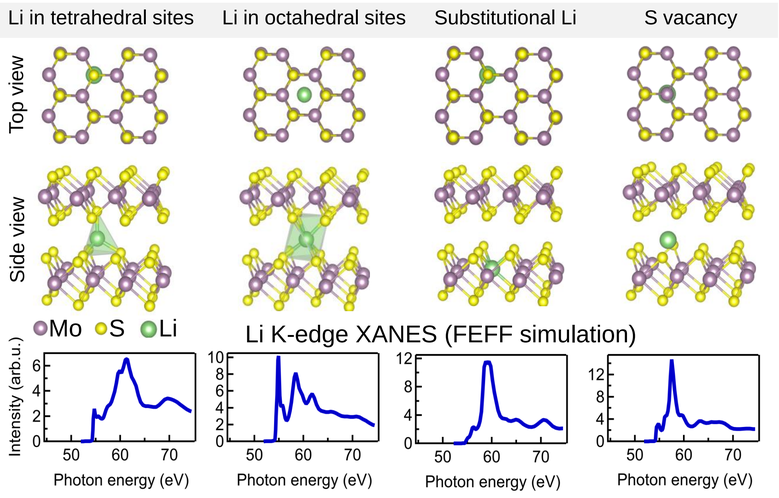


Li 1s XPS

Enhanced Li sensitivity (down to ~1 at. %)



Theory

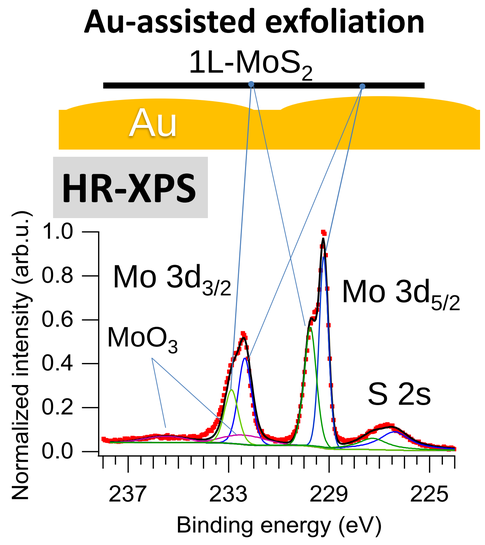


Chem. Mater. 2023, 35, 6246−6257; Appl. Phys. Lett. 124, 123101 (2024)

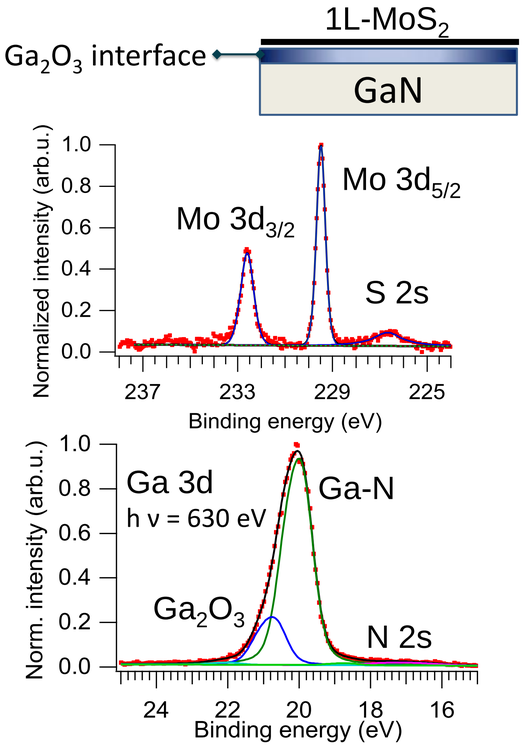
Single-layer MoS_2

Toward
2D materials/nitride semiconductors for low power consumption electronics and optoelectronics

Au-assisted exfoliation



Polymer-assisted transfer on GaN



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Contact: Igor Píš
pis@iom.cnr.it